

and xylene have a higher octane value than benzene, the transalkylation ~~of the known technique to give produce~~ them is preferred for increasing the octane value of gasoline.

Paragraph bridging Pages 2 and 3:

In general, benzene having been extracted out of gasoline is separated from gasoline through distillation. The benzene fraction contains a large amount of non-aromatic compounds of which the boiling point range is near to that of benzene, especially non-aromatic hydrocarbons such as olefins and naphthenes. In the case where the benzene fraction containing such a large amount of non-aromatic compounds is directly transalkylated with C9+ aromatic hydrocarbons in the presence of hydrogen, the aromatic transalkylation is often accompanied by a side reaction of paraffin decomposition. The side reaction of paraffin decomposition is problematic troublesome in that its hydrogen consumption is large and the reaction system is much undesirably heated owing to the decomposition heat.

Page 3, first full paragraph:

U.S. Patent 5,347,061 discloses a method of converting benzene in a gasoline distillate, and C9+ hydrocarbons, into C7 and C8 alkyl-aromatic hydrocarbons. In this, a benzene-rich C6 hydrocarbon stream derived from distillation of reformed gasoline, and a C9+ hydrocarbon stream are converted into C7 and C8 aromatic hydrocarbons through cracking, transalkylation and alkylation in the presence of an acidic metallosilicate catalyst. However, in the USP 5,347,061 method, the C9+ hydrocarbon is positively subjected to catalytic cracking to give produce an alkylating agent for benzene alkylation, for which, therefore, the presence production of a non-aromatic hydrocarbon is indispensable.

Paragraph bridging Pages 3 and 4:

Japanese Patent Laid-Open No. 38497/1997 discloses a method for converting aromatic hydrocarbons, in which a starting material that comprises a benzene-containing

distillate from a catalytically-reformed product of naphtha, and a trialkylbenzene-containing distillate from a catalytically-cracked product, is transalkylated in the presence of a crystalline aluminosilicate catalyst that carries a metal component of Group VIII of the Periodic Table therewith, to give a reaction product essentially comprising monoalkylbenzenes and dialkylbenzenes. They say thereinIt is stated that mordenite having a low morphology selectivity index is poorly practicable for the conversion as deactivating much through coking, while TSZ is preferred as its total adsorption capacity and morphology selectivity index are both large. The term "total adsorption capacity" referred to therein is meant to indicate the total of toluene, 1,2,4-trimethylbenzene and 1,2,3-trimethylbenzene adsorbed by the catalyst (in terms of ml/100 g of the catalyst, crystalline aluminosilicate); and the term "morphology selectivity index" is meant to indicate the ratio of toluene adsorption capacity/(1,2,4-trimethylbenzene + 1,2,3-trimethylbenzene) adsorption capacity of the catalyst.

Page 4, last paragraph:

Japanese Patent Laid-Open No. 155198/1997 discloses a method for converting C9+ aromatic hydrocarbon compounds in crude oil having a specific boiling point range and not containing benzene, into toluene and C8 aromatic hydrocarbon compounds, in the presence of hydrogen and by the use of a catalyst of a metal selected from metals of Group VIII and Group VIA of the Periodic Table or its compound carried by a carrier that contains zeolite having a maximum micropore diameter of from 0.6 to 1.0 nm and having a ratio of $\text{SiO}_2/\text{Al}_2\text{O}_3$ of at least 50. In this, they say it is indicated that mordenite is preferred for as the specific zeolite to be used, and nickel, palladium and molybdenum are preferred for as the metal.

Paragraph bridging Pages 5 and 6:

PCT application No. 98/12159 discloses a process for converting an aromatic

material that contains ethyl or propyl-~~having~~containing C9 hydrocarbon compounds in an amount of at least 20 %, into a toluene and xylene-rich product, in which the starting aromatic material is contacted with a catalyst that contains palladium-carrying de-aluminated mordenite having a silica/alumina ratio of from 12 to 30, in the presence of hydrogen to ~~give~~produce the product.

Page 6, third full paragraph:

In these examples, however, the aromatic compound conversion efficiency is low, and the references noted above say nothing how to treat non-aromatic compounds that may be present in the starting materials.

Page 6, fourth full paragraph:

One object of the present invention is to convert a benzene-containing, aromatic hydrocarbon material into C7, C8 and other useful aromatic hydrocarbons in the presence of a catalyst, ~~with~~ increasing the content of the useful aromatic hydrocarbons in the converted product.

Paragraph bridging Pages 6 and 7:

Another object of the invention is to convert a benzene-containing, aromatic hydrocarbon material into such useful aromatic hydrocarbons in the presence of a catalyst, ~~with~~while reducing the benzene content of the converted product.

Page 7, first full paragraph:

Still another object of the invention is to convert a benzene-containing, aromatic hydrocarbon material into such useful aromatic hydrocarbons in the presence of a catalyst, ~~with~~while reducing catalyst deactivation.

Page 7, second full paragraph:

Still another object of the invention is to convert a benzene-containing, aromatic hydrocarbon material into such useful aromatic hydrocarbons in the presence of a catalyst

and hydrogen, with depressing while reducing hydrogen consumption.

Page 7, third full paragraph:

To attain the objects as above, the invention provides a method for converting aromatic hydrocarbons, which comprises contacting a starting material of aromatic hydrocarbons that contains benzene and has a non-aromatic compound content of at most 1 % by weight, with a catalyst; and provides a method for converting aromatic hydrocarbons, which comprises removing non-aromatic compounds from a starting material of aromatic hydrocarbons that contains benzene and non-aromatic compounds so as to reduce the non-aromatic compound content of the starting material to ~~at most~~ 1 % by weight or less, followed by contacting the material with a catalyst.

Page 8, first full paragraph:

Preferably, the starting material is prepared from a crude material having a non-aromatic compound content of at least 1 % by weight, by removing non-aromatic compounds therefrom to reduce the non-aromatic compound content of the material to at most 1 % by weight. The converted aromatic hydrocarbons may be used as starting materials for ordinary chemicals. In the case where a benzene distillate from gasoline is used as the starting material in the invention, the converted aromatic hydrocarbons may be used as additional gasoline bases for the benzene-poor gasoline. In that manner of one preferred embodiment, the invention is favorable for effectively utilizing benzene extracted from gasoline.

Paragraph bridging Pages 8 and 9:

"Aromatic hydrocarbon conversion" in the invention concretely indicates a reaction selected from the group consisting of at least one of transalkylation, dealkylation and disproportionation. The reaction is effected under the conditionconditions under which at

least one of transalkylation, dealkylation and disproportionation reaction is effected, generally in the presence of hydrogen. The reaction pressure may fall between 0.1 and 100 MPa, preferably between 0.5 and 60 MPa, more preferably between 1 and 50 MPa. If the reaction pressure is too low, the catalyst used will soon deactivate and the reaction speed will lower; but if too high, it is uneconomic for the cost of equipment. The reaction temperature may fall between 200 and 650°C, preferably between 250 and 500°C. If the reaction temperature is too low, the reaction speed will lower; but if too high, the aromatic hydrocarbons being processed will much decompose and the catalyst used will soon deactivate. The hydrogen flow rate may fall between 0.1 and 20, preferably between 0.5 and 10 in terms of hydrogen/startling material (mol/mol). If the hydrogen flow rate is too low, the catalyst used will soon deactivate; but if too high, it is uneconomic.

Marked-Up Version of the Claims

Kindly amend the Claims as follows:

1. (Amended) A method for converting aromatic hydrocarbons to C7 and C8 aromatic hydrocarbons, which method comprises contacting a benzene-containing, aromatic hydrocarbon starting material having comprising aromatic hydrocarbons, wherein said aromatic hydrocarbons comprise benzene and other aromatic hydrocarbons containing a non-aromatic compound content of at most 1 % by weight or less, with a catalyst to perform at least one reaction selected from the group consisting of transalkylation, dealkylation and disproportionation, thereby converting said starting material into C7 or C8 aromatic hydrocarbons; wherein hydrogen is present in said reaction.

2. (Amended) The A method for converting aromatic hydrocarbons as claimed in claim 1, to C7 and C8 aromatic hydrocarbons, which method comprises contacting a starting material comprising aromatic hydrocarbons, wherein [said hydrocarbons] comprise at least benzene, and [a non-aromatic compound content of greater than 1% by weight] with a catalyst in the presence of hydrogen to perform at least one reaction selected from the group consisting of transalkylation, dealkylation, and disproportionation, wherein said non-aromatic compounds are first removed from a crude aromatic hydrocarbon material that contains said benzene and non-aromatic compounds, so as to make thereby reducing the non-aromatic compound content of the said material reduced to at most 1 % by weight or less, and thereafter the material is converted in said reaction into C7 or C8 aromatic hydrocarbons.

3. (Amended) The method for converting aromatic hydrocarbons as claimed in any one of claims 1 and 2, wherein the said aromatic hydrocarbon conversion reaction is for transalkylation.

5. (Amended) The method for converting aromatic hydrocarbons as claimed in any one of claims 1 to 4 Claim 1 or 2, wherein the starting material contains C9+ alkyl-aromatic hydrocarbons. 102

6. (Amended) The method for converting aromatic hydrocarbons as claimed in claim 5, wherein said benzene and said C9+ aromatic hydrocarbons in the starting material are reduced and C7 and C8 aromatic hydrocarbons in the product are increased produced. 102

7. (Amended) The method for converting aromatic hydrocarbons as claimed in any one of claims 1 to 6 Claim 1 or 2, wherein the said catalyst contains zeolite. 102

8. (Amended) The method for converting aromatic hydrocarbons as claimed in any one of claims 1 to 7 Claim 1 or 2, wherein the said catalyst contains at least one of metals of Group VIB, Group VIIIB and Group VIII of the Periodic Table. 102

9. (Amended) The method for converting aromatic hydrocarbons as claimed in any one of claims 1 to 8 Claim 1 or 2, wherein the said catalyst contains mordenite and rhenium. 102

10. (Amended) A method for producing C7 and C8 aromatic hydrocarbons, which comprises mixing a benzene-containing fraction obtained through gasoline fractionation comprising benzene, with an aromatic hydrocarbon material that contains C9+ aromatic hydrocarbons to create a mixture having a non-aromatic compound content greater than 1% by weight, reducing the said non-aromatic compound content of the resulting said mixture to at most 1 % by weight or less, then contacting reacting the mixture with a catalyst to thereby convert the aromatic hydrocarbons therein, and separating the resulting C7 and C8 aromatic hydrocarbons from the reaction mixture.

Please cancel Claim 4 without prejudice and without disclaimer of the subject matter contained therein.

Marked-Up Version of the Abstract

Provided is a method for converting aromatic hydrocarbons, which comprises contacting a benzene-containing, by contacting an aromatic hydrocarbon starting material including benzene and having a non-aromatic compound content of at most 1% by weight or less, with a catalyst. Through the method, to generate useful C7 and C8 aromatic hydrocarbons like C7 and C8 are efficiently increased and while reducing the catalyst deactivation is reduced.

Remarks

We note with appreciation acknowledgment of the claim for foreign priority under 35 U.S.C. §119, as well as receipt of the foreign priority documents.

The Specification, Claims and Abstract have been amended to correct minor typographical and idiomatic errors and to clarify the scope of the disclosure without adding new matter.

Claims 1-3 and 5-10 are present in the case, Claim 4 being hereby withdrawn without prejudice or disclaimer of the subject matter contained therein. Claims 5-9 have been amended to comply with 37 C.F.R. 1.75(c). Thus, we respectfully request treatment of those claims on the merits.

We respectfully submit that Claims 1-3 and 5-10 as amended fully comply with 35 U.S.C. §112, second paragraph. The expression "benzene-containing aromatic hydrocarbon material" in original Claim 1 has been amended to recite "starting material comprising aromatic hydrocarbons, wherein said aromatic hydrocarbons comprise benzene and other aromatic hydrocarbons". Specifically, Claim 1 has been amended to recite a conversion step whereby the recited starting material is converted into C7 or C8 aromatic hydrocarbons by a reaction selected from the group consisting of transalkylation, dealkylation and disproportionation. Amended Claim 1 clarifies that the function of the contacting step is to bring the starting material into contact with the catalyst to catalyze the conversion of the starting material into C7 or C8 aromatic hydrocarbons.

Claims 2 and 10 have been amended to recite a starting material comprising a non-aromatic compound content of greater than 1% by weight. Thus, reduction of the non-aromatic compound content of the starting material to 1% by weight or less is consistent with the rest of the Claim as amended. Claim 2 has further been amended to recite the reduction step positively. Claim 3 has been clarified by eliminating the term "for".

In light of the foregoing amendments, we respectfully submit that the solicited claims satisfy the statutory requirements of 35 U.S.C. §112, second paragraph.

Turning to the application on its merits, we respectfully submit that the present invention as defined by the solicited claims are distinguishable over the disclosures of the cited prior art references. Specifically, independent Claim 1 as amended encompasses a reaction step in the presence of hydrogen. As explained at page 9 of the Specification, the presence of hydrogen prevents the activation of the catalyst. In sharp contrast, U.S. Patent 5,030,786 to Shamshoum, et al. (Shamshoum) fails to disclose reaction in the presence of hydrogen. ||||

Independent Claim 1 has further been amended to clarify that the starting material comprising aromatic hydrocarbons, wherein the hydrocarbons comprise at least benzene and other aromatic hydrocarbons, is converted into C7 or C8 aromatic hydrocarbons. As explained in the Specification at page 7 and elsewhere, one objective of the present invention is to reduce the benzene content of the converted product. In sharp contrast, WO 96/24568 to Buchanan, et al. (Buchanan) teaches conversion of heavy aromatics to lighter aromatics including benzene. As demonstrated by the examples of Buchanan, specifically in Tables 5 and 6, the benzene content of the converted product is significantly greater than that of the feed stock. ← ↗

In light of these distinctions, we respectfully submit that neither Shamshoum nor Buchanan anticipates the present invention as defined by amended Claims 1 and 3.

Turning to Claims 2 and 10, we agree with the Examiner that neither Shamshoum nor Buchanan teaches nor suggests the use of a starting benzene feed containing non-aromatics derived from gasoline fractionation. A *prima facie* case of obviousness under 35 U.S.C. §103 requires that all claim limitations be taught or suggested by the prior art. A statement that modifications of the prior art to meet the claimed invention would have been "well

within the ordinary skill of the art at the time the claimed invention was made" is not sufficient to establish a *prima facie* case of obviousness. See *Ex parte Levengood*, 28 U.S.P.Q.2d 1300 (Board of Patent Appeals and Interferences 1993).

Moreover, amended Claim 2 recites the presence of hydrogen in the catalyzed conversion reaction. As explained previously, Shamshoum fails to disclose or even suggest reaction in the presence of hydrogen.

Furthermore, Claims 2 and 10 have been amended to encompass a starting material having greater than 1% by weight non-aromatic compound content. We again agree with the Examiner that neither Shamshoum nor Buchanan discloses such a non-aromatic compound content in the feed stock or a step to reduce the non-aromatic compound content to 1% by weight or less. Again, the ordinary level of skill within the art cannot be relied upon to establish a *prima facie* case of obviousness. "Obvious to try" is simply not the standard under §103. Therefore, we respectfully submit that neither Shamshoum nor Buchanan precludes the patentability of the present invention as defined by solicited Claims 2 and 10 under §103.

In light of the foregoing, we respectfully urge withdrawal of the Shamshoum and Buchanan references as grounds for rejection. Accordingly, we respectfully submit that Claims 1-3 and 5-10, as amended, are in proper form for allowance, which early action is requested.

Respectfully submitted,



T. Daniel Christenbury
Reg. No. 31,750

ARM:FG:dh
(215) 563-1810